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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/803,801	HADDAD, KHALIL CAMILLE
	Examiner	**Art Unit**
	Jason M Perilla	2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 March 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-28 are pending in the instant application.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 7, 8, 25 and 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 7, the variables α, β, and ω are not defined, and the claim is therefore indefinite. A definition and/or a suggestion of the value of variables α, β, and ω should be provided in the claim. Further, it is unclear how the impulse response h of length N shortens the impulse response of the channel because it is defined as the impulse response itself. ***No new matter should be entered.***

Regarding claim 8 the variables α, β, and ω are not defined, and the claim is therefore indefinite. A definition and/or a suggestion of the value of variables α, β, and ω should be provided in the claim. It is unclear how the impulse response h of length N shortens the impulse response of the channel because it is defined as the impulse response itself. Further, no definition of $\Phi(\omega)$ or $A(\omega)$ is made which describes the unit or purpose of the function, and no relation is made between the function $\Phi(\omega)$ and the function $A(\omega)$ to provide unity among the set of frequency constraints. ***No new matter should be entered.***

Regarding claim 25, the variables α, β, and ω are not defined, and the claim is therefore indefinite. A definition and/or a suggestion of the value of variables α, β, and ω should be provided in the claim. Further, it is unclear how the impulse response h of length N shortens the impulse response of the channel because it is defined as the impulse response itself. ***No new matter should be entered.***

Regarding claim 26 the variables α, β, and ω are not defined, and the claim is therefore indefinite. A definition and/or a suggestion of the value of variables α, β, and ω should be provided in the claim. It is unclear how the impulse response h of length N shortens the impulse response of the channel because it is defined as the impulse response itself. Further, no definition of Φ(ω) or A(ω) is made which describes the unit or purpose of the function, and no relation is made between the function Φ(ω) and the function A(ω) to provide unity among the set of frequency constraints. ***No new matter should be entered.***

Claim Rejections - 35 USC § 102

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claim1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor (6396886).

Regarding claim 1, Kapoor discloses a method for determining coefficient values for a shortening impulse response filter (SIRF) (fig. 1; col. 4, lines 18-30), said method comprising the steps of: establishing at least one set defining constraints that said SIRF

filter must satisfy in a time domain (col. 4, lines 4-10; col. 6, lines 50-57); establishing at least one set defining constraints that said SIRF filter must satisfy in a frequency domain (col. 4, lines 10-13; col. 6, lines 58-63); and determining an intersecting set of said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints. It is inherent that an intersecting set of the time domain constraints and the frequency domain constraints is determined because the method for determining coefficient values of Kapoor accounts for both the time domain constraints as well as the frequency domain constraints while the coefficients are chosen. Furthermore, one skilled in the art identifies that the constraining factors of any filter design are embodied by time domain constraints such as output overshoot and frequency domain constraints such as the input/output signal attenuation over the frequency bandwidth and do not present a novel approach or insight to the design.

Regarding claim 4, Kapoor discloses the limitations of claim 1 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

Regarding claim 11, Kapoor discloses a shortening impulse response filter (SIRF), comprising: a set of finite impulse response (FIR) coefficients (col. 4, lines 17-19) satisfying at least one constraint in a time domain (col. 4, lines 4-10; col. 6, lines 50-57) and at least one constraint in a frequency domain (col. 4, lines 10-13; col. 6, lines 58-63), wherein said at least one time domain constraint is represented as at least one first set and wherein said at least one frequency domain constraint is represented as at least one second set (col. 4, lines 4-13), wherein said finite impulse response (FIR)

coefficients are determined by an intersecting set of said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints. It is inherent that the constraints are represented by a "set" and that an intersecting set of the time domain constraints and the frequency domain constraints is determined because the method for determining coefficient values of Kapoor accounts for both the time domain constraints as well as the frequency domain constraints while the coefficients are chosen. Furthermore, one skilled in the art identifies that the constraining factors of any filter design are embodied by time domain constraints such as output overshoot and frequency domain constraints such as the input/output signal attenuation over the frequency bandwidth and do not present a novel approach or insight to the design.

Regarding claim 14, Kapoor discloses the limitations of claim 1 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Shinde (6192386).

Regarding claim 2, Kapoor discloses the limitations of claim 1 as applied above. Kapoor does not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a linear phase. However, Shinde teaches an analogous digital finite impulse response (FIR) filter (abstract). Shinde also teaches that an advantage of a linear filter is that it does not produce any phase distortion with respect to the input frequency (col. 7, line 64-col. 8, line 8). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a linear phase as taught by Shinde in the method of Kapoor because such methods are commonly known in the art, and the linear phase characteristic of the filter would not produce distortion.

Regarding claim 12, Kapoor discloses the limitations of claim 11 as applied above. Kapoor does not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a linear phase. However, Shinde teaches an analogous digital finite impulse response (FIR) filter (abstract). Shinde also teaches that an advantage of a linear filter is that it does not produce any phase distortion with respect to the input frequency (col. 7, line 64-col. 8, line 8). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design

constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a linear phase as taught by Shinde in the method of Kapoor because such methods are commonly known in the art, and the linear phase characteristic of the filter would not produce distortion.

7. Claims 3 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Goldberg et al ("Design of Finite Impulse Response Digital Filters with Nonlinear Phase Response", Goldberg, Eli et al; hereafter "Goldberg").

Regarding claim 3, Kapoor discloses the limitations of claim 1 as applied above. Kapoor does not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a non-linear phase. However, Goldberg teaches a method of designing a digital FIR filter having a non-linear phase response (abstract). Goldberg teaches that a properly designed non-linear phase filter needs fewer coefficients that an optimal linear phase filter having the same gain response (pg. 1005, col. 2, line 43-44 – page 1006, col. 1, line 2). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that

the SIRF filter must satisfy to define a filter having a non-linear phase response as taught by Goldberg in the method of Kapoor because such methods are commonly known, and the non-linear phase filter may require fewer coefficients with respect to a linear phase filter having the same gain response which provides for a less costly implementation.

Regarding claim 13, Kapoor discloses the limitations of claim 11 as applied above. Kapoor does not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a non-linear phase. However, Goldberg teaches a method of designing a digital FIR filter having a non-linear phase response (abstract). Goldberg teaches that a properly designed non-linear phase filter needs fewer coefficients that an optimal linear phase filter having the same gain response (pg. 1005, col. 2, line 43-44 – page 1006, col. 1, line 2). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a non-linear phase response as taught by Goldberg in the method of Kapoor because such methods are commonly known, and the non-linear phase filter may require fewer coefficients with respect to a linear phase filter having the same gain response which provides for a less costly implementation.

8. Claims 5, 6, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Hamming et al (4074212; hereafter "Hamming").

Regarding claim 5, Kapoor discloses the limitations of claim 1 as applied above. Kapoor does not disclose that the frequency domain constraints include a frequency response for said SIRF filter that does not attenuate a received signal. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat attenuation response in the frequency pass-band (fig. 5). Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band as taught by Hamming in the method of Kapoor because it is known that a perfect filter should pass a particular frequency band without attenuating it.

Regarding claim 6, Kapoor discloses the limitations of claim 1 as applied above. Kapoor does not disclose that the frequency domain constraints include a frequency response for said SIRF filter that does not attenuate a received signal. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat

attenuation response in the frequency pass-band (fig. 5). Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band as taught by Hamming in the method of Kapoor because it is known that a perfect filter should pass a particular frequency band without attenuating it.

Regarding claim 15, Kapoor discloses the limitations of claim 11 as applied above. Kapoor does not disclose that the frequency domain constraints include a frequency response for said SIRF filter that does not attenuate a received signal. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat attenuation response in the frequency pass-band (fig. 5). Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of

frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band as taught by Hamming in the method of Kapoor because it is known that a perfect filter should pass a particular frequency band without attenuating it.

Regarding claim 16, Kapoor discloses the limitations of claim 11 as applied above. Kapoor does not disclose that the frequency domain constraints include a frequency response for said SIRF filter that does not attenuate a received signal. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat attenuation response in the frequency pass-band (fig. 5). Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band as taught by Hamming in the method of Kapoor because it is known that a perfect filter should pass a particular frequency band without attenuating it.

9. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Shinde, and in further view of Hamming.

Regarding claim 7, Kapoor in view of Shinde disclose the limitations of claim 2 as applied above. Further, claim 7 provides that the defining set of frequency domain constraints is made such that the impulse response is nearly unity (+ or - α) in the pass-band, and less than β in the stop band. Kapoor in view of Shinde do not explicitly disclose such a frequency response. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat (unity) attenuation response in the frequency pass-band (fig. 5) and an attenuating response in the stop-band. Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band and severe attenuation over a stop-band as taught by Hamming in the method of Kapoor in view of Shinde because it is known that a perfect filter should pass a pass-band without attenuating it and severely attenuate a stop-band.

10. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Goldberg, and in further view of Hamming.

Regarding claim 8, Kapoor in view of Goldberg disclose the limitations of claim 3 as applied above. Further, claim 8 provides that the defining set of frequency domain constraints is made such that the impulse response is nearly unity (+ or - α) in the pass-band and less than β in the stop band. The constraints also provide for a non-linear phase response $\Phi(\omega)$. While Goldberg discloses a filter having a non-linear phase response, Kapoor in view of Goldberg do not explicitly disclose the frequency response defined by the limitations. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat (unity) attenuation response in the frequency pass-band (fig. 5) and an attenuating response in the stop-band. Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band and severe attenuation over a stop-band as taught by Hamming in the

method of Kapoor in view of Goldberg because it is known that a perfect filter should pass a pass-band without attenuating it and severely attenuate a stop-band.

11. Claims 9, 10, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Haddad et al ("Design of Digital Linear-Phase FIR Crossover Systems of Loudspeakers by the Method of Vector Space Projections", Haddad, Khalil C.; hereafter "Haddad").

Regarding claim 9, Kapoor discloses the limitations of claim 9 as applied above. Kapoor does not disclose employing vector space projection methods to determine said intersecting set. However, the method of vector space projection is already well known as published and taught by Haddad (pg. 3059, col. 2). Haddad teaches a means to solve a mathematical problem which encompasses multiple constraints by vector space projection. Therefore, it would have been obvious to one having ordinary skill in the art to utilize vector space projection as taught by Haddad in the method of Kapoor because it can be advantageously used to solve the mathematical problem outlined by multiple constraints.

Regarding claim 10, Kapoor in view of Haddad disclose the limitations of claim 9 as applied above. Further, Haddad discloses that the vector space projection method is iteratively applied to said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints until said sets converge to a set of coefficients satisfying said time domain constraints and said frequency domain constraints (fig. 2).

Regarding claim 17, Kapoor discloses the limitations of claim 11 as applied above. Kapoor does not disclose employing vector space projection methods to determine said intersecting set. However, the method of vector space projection is already well known as published and taught by Haddad (pg. 3059, col. 2). Haddad teaches a means to solve a mathematical problem which encompasses multiple constraints by vector space projection. Therefore, it would have been obvious to one having ordinary skill in the art to utilize vector space projection as taught by Haddad in the method of Kapoor because it can be advantageously used to solve the mathematical problem outlined by multiple constraints.

Regarding claim 18, Kapoor in view of Haddad disclose the limitations of claim 17 as applied above. Further, Haddad discloses that the vector space projection method is iteratively applied to said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints until said sets converge to a set of coefficients satisfying said time domain constraints and said frequency domain constraints (fig. 2).

12. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Gandhi et al (6112218; hereafter "Ghandi").

Regarding claim 1, Kapoor discloses a method for determining coefficient values for a shortening impulse response filter (SIRF) (fig. 1; col. 4, lines 18-30), said method comprising the steps of: establishing at least one set defining constraints that said SIRF filter must satisfy in a time domain (col. 4, lines 4-10; col. 6, lines 50-57); establishing at least one set defining constraints that said SIRF filter must satisfy in a frequency

domain (col. 4, lines 10-13; col. 6, lines 58-63); and determining an intersecting set of said at least one set defining said time domain constraints and said at least one set defining said frequency domain constraints. It is inherent that an intersecting set of the time domain constraints and the frequency domain constraints is determined because the method for determining coefficient values of Kapoor accounts for both the time domain constraints as well as the frequency domain constraints while the coefficients are chosen. Furthermore, one skilled in the art identifies that the constraining factors of any filter design are embodied by time domain constraints such as output overshoot and frequency domain constraints such as the input/output signal attenuation over the frequency bandwidth and do not present a novel approach or insight to the design. Although digital signal processors (DSP) executing instructions stored on memory communicatively coupled to them are notoriously known for implementing digital embodiments, Kapoor does not disclose the use of one. However, Ghandi does teach the use of a DSP and a memory for implementing a filter (abstract; col. 18, lines 28-35). Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize a memory and a DSP as taught by Ghandi in the method of Kapoor because it provides an exceptionally flexible means to implement the filter.

Regarding claim 22, Kapoor discloses the limitations of claim 19 as applied above. Further, Kapoor discloses that the time domain constraints specify a shortening of a channel impulse response (col. 2, lines 31-40; col. 4, lines 4-9).

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Ghandi and in further view of Shinde.

Regarding claim 20, Kapoor in view of Ghandi disclose the limitations of claim 19 as applied above. Kapoor in view of Ghandi do not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a filter having a linear phase. However, Shinde teaches an analogous digital finite impulse response (FIR) filter (abstract). Shinde also teaches that an advantage of a linear filter is that it does not produce any phase distortion with respect to the input frequency (col. 7, line 64-col. 8, line 8). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a linear phase as taught by Shinde in the method of Kapoor in view of Ghandi because such methods are commonly known in the art, and the linear phase characteristic of the filter would not produce distortion.

14. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Ghandi and in further view of Goldberg.

Regarding claim 21, Kapoor in view of Ghandi disclose the limitations of claim 19 as applied above. Kapoor in view of Ghandi do not disclose that the at least one set defining constraints that said SIRF filter must satisfy in a frequency domain define a

filter having a non-linear phase. However, Goldberg teaches a method of designing a digital FIR filter having a non-linear phase response (abstract). Goldberg teaches that a properly designed non-linear phase filter needs fewer coefficients that an optimal linear phase filter having the same gain response (pg. 1005, col. 2, line 43-44 – page 1006, col. 1, line 2). One skilled in the art is familiar with the design of digital filters and how to design both linear and non-linear phase filters with respect to any chosen design constraint. It is common that the design constraints alone may define the filter to have a linear or non-linear phase output with respect to the input. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to set defining constraints that the SIRF filter must satisfy to define a filter having a non-linear phase response as taught by Goldberg in the method of Kapoor in view of Ghandi because such methods are commonly known, and the non-linear phase filter may require fewer coefficients with respect to a linear phase filter having the same gain response which provides for a less costly implementation.

15. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Ghandi and in further view of Hamming.

Regarding claim 23, Kapoor in view of Ghandi disclose the limitations of claim 19 as applied above. Kapoor in view of Ghandi do not disclose that the frequency domain constraints include a frequency response for said SIRF filter that does not attenuate a received signal. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat attenuation response in the frequency pass-band (fig. 5). Hamming teaches cascaded filters wherein the overall response of the filters provides

for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band as taught by Hamming in the method of Kapoor in view of Ghandi because it is known that a perfect filter should pass a particular frequency band without attenuating it.

Regarding claim 24, Kapoor in view of Ghandi disclose the limitations of claim 19 as applied above. Kapoor in view of Ghandi do not disclose that the frequency domain constraints include a frequency response for said SIRF filter that does not attenuate a received signal. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat attenuation response in the frequency pass-band (fig. 5). Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for

stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band as taught by Hamming in the method of Kapoor in view of Ghandi because it is known that a perfect filter should pass a particular frequency band without attenuating it.

16. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Ghandi, in further view of Shinde, and in further view of Hamming.

Regarding claim 25, Kapoor in view of Ghandi and in further view of Shinde disclose the limitations of claim 20 as applied above. Further, claim 7 provides that the defining set of frequency domain constraints is made such that the impulse response is nearly unity (+ or - α) in the pass-band, and less than β in the stop band. Kapoor in view of Ghandi and in further view of Shinde do not explicitly disclose such a frequency response. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat (unity) attenuation response in the frequency pass-band (fig. 5) and an attenuating response in the stop-band. Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it

would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band and severe attenuation over a stop-band as taught by Hamming in the method of Kapoor in view of Ghandi and in further view of Shinde because it is known that a perfect filter should pass a pass-band without attenuating it and severely attenuate a stop-band.

17. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Ghandi, in further view of Goldberg, and in further view of Hamming.

Regarding claim 8, Kapoor in view of Ghandi and in further view of Goldberg disclose the limitations of claim 3 as applied above. Further, claim 8 provides that the defining set of frequency domain constraints is made such that the impulse response is nearly unity (+ or - α) in the pass-band and less than β in the stop band. The constraints also provide for a non-linear phase response $\Phi(\omega)$. While Goldberg discloses a filter having a non-linear phase response, Kapoor in view of Ghandi and in further view of Goldberg do not explicitly disclose the frequency response defined by the limitations. However, Hamming et al teaches a FIR filter (col. 3, lines 7-9) which has an essentially flat (unity) attenuation response in the frequency pass-band (fig. 5) and an attenuating response in the stop-band. Hamming teaches cascaded filters wherein the overall response of the filters provides for a reduced pass-band amplitude variation (col. 2, lines 3-10). One skilled in the art is familiar with the teachings of Hamming. The frequency response of the filter designed by Hamming provides for an essentially flat amplitude response over the pass-band. This equates to no attenuation. One skilled in

the art knows that a perfect filter will pass a defined set of frequencies without attenuation and will provide infinite attenuation for stop-band frequencies. Therefore, it would have been obvious to one having ordinary skill in the art at the time which the invention was made to utilize frequency domain constraints that include a frequency response that does not attenuate a received signal over a given pass-band and severe attenuation over a stop-band as taught by Hamming in the method of Kapoor in view of Ghandi and in further view of Goldberg because it is known that a perfect filter should pass a pass-band without attenuating it and severely attenuate a stop-band.

18. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kapoor in view of Ghandi and in further view of Haddad et al.

Regarding claim 27, Kapoor in view of Ghandi disclose the limitations of claim 19 as applied above. Kapoor in view of Ghandi do not disclose employing vector space projection methods to determine said intersecting set. However, the method of vector space projection is already well known as published and taught by Haddad (pg. 3059, col. 2). Haddad teaches a means to solve a mathematical problem which encompasses multiple constraints by vector space projection. Therefore, it would have been obvious to one having ordinary skill in the art to utilize vector space projection as taught by Haddad in the method of Kapoor in view of Ghandi because it can be advantageously used to solve the mathematical problem outlined by multiple constraints.

Regarding claim 28, Kapoor in view of Ghandi and in further view of Haddad disclose the limitations of claim 19 as applied above. Further, Haddad discloses that the vector space projection method is iteratively applied to said at least one set defining

said time domain constraints and said at least one set defining said frequency domain constraints until said sets converge to a set of coefficients satisfying said time domain constraints and said frequency domain constraints (fig. 2).

Conclusion

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following prior art of record not relied upon above is cited to further show the state of the art with respect to SIRF filters.

a. U.S. Pat. No. 6526105 to Harikumar et al.

b. U.S. Pat. No. 6678318 to Lai.

c. P. J. Melsa et al, "Impulse Response Shortening for Discrete Multitone Transceivers," IEEE Trans. On Comm. Vol. 44, No. 12, pp. 1662-71, December 1996

d. J. S. Chow et al, "Equalizer Training Algorithms for Multicarrier Modulation Systems", 1993 International Conference on Communications, pages 761-765, Geneva, (May 1993)

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M Perilla whose telephone number is (703) 305-0374. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Chin can be reached on (703) 305-4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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